APPLICATION FOR UNITED STATES LETTERS PATENT

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TITLE: METHOD AND MACHINE FOR PRODUCING A CONTINUOUS FILTER ROD

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CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the priority of European Patent Application with Serial No. 03 007 675.6, filed on April 3, 2003, the disclosure of which, together with the disclosure of each and every U.S. and foreign patent and patent application mentioned below are incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] The invention relates to a method and a machine for producing a continuous filter rod.

[0003] A method for processing filter material and the corresponding filter material processing machinery used in the tobacco industry are known from British Patent Document GB 718 332, in which material snippets are produced with a tobacco cutter and are then fed to a continuous rod machine in a manner similar to that in cigarette machines. The snippets are impregnated with a chemical agent to prevent an undesirable taste and to prevent the snippets from falling out of the end pieces of the subsequently produced filters The snippets are conveyed with a roller to the operating region of a spiked feed roller and are then moved by the spiked feed roller to a conveying belt, so that the snippets can subsequently be fed to a second spiked roller. The snippets are knocked from the second spiked feed roller by a

further spiked or beater roller and supplied to a format device where the continuous filter rod is formed by wrapping material around the fiber rod. The snippets consist of materials such as paper, cellulose, textile, synthetic materials and the like and have a texture that is similar to cut tobacco.

[0004] The shape of the snippets makes it very difficult to produce filters with homogeneous characteristics. In addition, the options of adjusting the filter characteristics are very limited.

BRIEF SUMMARY OF THE INVENTION

[0005] In contrast to the above-mentioned prior art, it is an object of the present invention to develop a method and a machine for producing continuous filter rods with homogeneous filter characteristics.

[0006] This and other objects are solved according to the invention by the provision of a method for producing continuous filter rods. At least one type of finite, essentially completely separated fibers is transported with transport air to a conveyor. A fiber nonwoven is formed on one surface of the conveyor to result in the fibers at least partially contacting one another. The fiber nonwoven is deposited onto and wrapped with a wrapping material web.

[0007] A continuous filter rod with very homogeneous filter characteristics is obtained when essentially completely separated fibers are transported, in particular with transport air, in the direction of a conveyor, such that a fiber nonwoven forms on a conveyor surface. In the exemplary embodiment, the conveyor is a belt conveyor, and can be provided with a suction belt.

[0008] A uniform shape of the continuous filter rod can be achieved if the fiber nonwoven is compacted while being wrapped with the wrapping material web. Supplying energy to the fiber nonwoven during wrapping generates a solid bond at the fiber contacting points to result in a relatively elastic filter and ensures that no fiber material is lost at the cutting edges of the filter and/or the filter element.

[0009] Particularly homogeneous filter characteristics can be obtained by using fibers having a fiber length that is shorter than the length of the filter and/or filter element cut from the produced continuous filter rod. In the exemplary embodiment, the fibers utilized have an average fiber diameter in the range of 10 to 40μm, and can be in the range of 20 to 38μm. Thus, in an exemplary embodiment, the fibers are elongated and relatively thin. The filter characteristics can be adjusted if additives such as activated

carbon granulate, triacetin or latex are added to the fibers. Activated carbon granulate is added, for example, to the fibers before they are completely separated or is added to the fibers being transported to the conveyor. Triacetin and/or latex as bonding agents are added, for example, to the compiled fiber nonwoven in the conveyor region.

[0010] A particularly uniform compaction is ensured if the fiber nonwoven is compacted prior to the step of deposition on the wrapping material web. For this, the material is compacted vertically as well as horizontally, i.e., from the top and from the bottom as well as from the sides of the fiber nonwoven.

[0011] A particularly simple process sequence is ensured if the fiber nonwoven is removed from the conveyor with mechanical force, in particular with compressed air, to deposit the fiber nonwoven on the wrapping material web.

[0012] In one exemplary embodiment, the fiber nonwoven is formed prior to being deposited on the wrapping material web. This forming step, for example, can include at least the forming of a semicircle crosswise to the conveying direction of the nonwoven, or a full circle or oval can be formed.

[0013] A filter or a filter element is produced according to the invention by subsequently cutting the continuous filter rod into sections of a specific length.

[0014] The present invention also includes a machine for producing a continuous filter rod. The machine includes a fiber compiling device that transports separated fiber materials with transport air to a conveyor to form a fiber nonwoven. A format device wraps a material web around the fiber nonwoven. A transferring device then transfers the fiber nonwoven from the conveyor to the format device.

[0015] A particularly homogeneous fiber nonwoven can be produced by transporting the separated filter materials with transport air, such that an especially homogeneous continuous filter rod can be produced, to result in particularly homogeneous filter and/or filter elements.

[0016] The filter characteristics can be positively influenced if at least one compacting device is provided in the area of the conveyor. In the exemplary embodiment, the conveyor or a section of the conveyor can form a component of the compacting device. The conveyor can be at least one suction belt. If the processed fibers are small enough so that the openings of the suction belt are quickly clogged, it is advantageous if two additional suction belts are used for the

operation, which are respectively arranged at an approximately right angle on both sides of the first suction belt. The fiber nonwoven can be transferred with particular efficiency if compressed air is used to remove the nonwoven from the conveyor.

[0017] If the device for transferring the fiber nonwoven comprises a transport belt, then the fiber nonwoven can be shaped to meet the characteristics and/or the form of the filter to be produced. In the exemplary embodiment, the transport belt is a suction belt, and the transport belt can be bent crosswise to the transporting direction, thus making it easy to produce, for example, a continuous filter rod with circular and/or oval cross section. Two transport belts can be provided to hold and transport the fiber nonwoven in between to form the circular and/or oval cross section. The transport belts can be designed such that the fiber nonwoven is formed into an oval shape, a circular shape, a semi-circular shape, or a half-oval shape.

[0018] An alternative transfer device for transferring the fiber nonwoven includes a nozzle through which the fiber nonwoven can be transported. In the exemplary embodiment, the nozzle is designed such that the fiber nonwoven can assume a round or oval shape.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The invention is described in the following with the aid of exemplary embodiments and without restricting the general inventive idea by referring to the drawings, to which reference is made for all details of the invention not explicity explained in the text.

[0020] Figure 1 shows a three-dimensional schematic representation of a separating device and a section of a compiling device in accordance with the present invention.

[0021] Figure 2 shows a schematic view of a first exemplary embodiment of a continuous filter rod machine in accordance with the present invention.

[0022] Figure 3 shows a plan view of a section of the continuous filter rod machine of Fig. 2, as viewed in the direction of arrow A.

[0023] Figure 4 shows a side view of a section of the continuous filter rod machine of Fig. 2, as viewed in the direction of arrow B.

[0024] Figure 5 shows a schematic view of a second exemplary embodiment of a continuous filter rod machine in accordance with the present invention.

[0025] Figure 6 shows a plan view of a section of the continuous filter rod machine of Fig. 5, as viewed in the direction of arrow A.

[0026] Figure 7 shows a side view of a section of the continuous filter rod machine of Fig. 5, as viewed in the direction of arrow B.

[0027] Figure 8 shows a side schematic view of a section of the continuous filter rod machine of Fig. 2, with portions the machine omitted for reasons of clarity.

[0028] Figure 9 shows a top schematic view of the section of the continuous filter rod machine shown in Fig. 8.

[0029] Figure 10 shows a schematic three-dimensional section of the continuous filter rod machine shown in Fig. 2.

[0030] Figure 11 shows a schematic view of a section of a continuous filter rod machine shown in Fig. 8..

[0031] Figure 12 shows a schematic view of a section of a continuous filter rod machine shown in Fig. 2.

DETAILED DESCRIPTION OF THE INVENTION

[0032] In the Figures described herein, the same reference numbers are used for identical or similar elements and/or parts, so that these do not need to be introduced again.

[0033] Referring to Fig. 1, there is shown a three-dimensional representation of a separating device 10 is a variant of a separating device disclosed in an European Patent Application No. 03007672.3 by the assignee of the present application and entitled "VERFAHREN ZUR AUFBEREITUNG ENDLICHER FASERN UND AUFBEREITUNGSEINRIGHTUNG FUER ENDLICHE FASERN ZUR VERWENDUNG BEI DER HERSTELLUNG VON FILTERN" ["Method for Processing Finite Fibers and Processing Device for Finite Fibers Used for the Production of Filters,"] filed on August 8, 2003 in the European Patent Office. The above-mentioned European Patent Application is directed to the respective processing of fiber material used for the production of filters to obtain essentially completely separated fibers for producing a homogeneous continuous filter rod. The separating device 10, among others, can be used for this purpose. If necessary, the filter material and/or the fiber material is separated and portioned out ahead of time.

[0034] The mostly non-separated fiber material and/or fiber/fiber group mixture 49, as shown in the schematic representation of Fig. 4, is moved via an accumulation chute 44 and feed rollers 46 to the operating range of a spiked feed roller 76, which knocks out and pre-separates the fiber/fiber group mixture 49. This fiber/fiber group mixture 49 is then

transported with air flow 19 to a screening drum 21, as shown in Fig. 1, via openings 20 on the side of a housing 22. In Fig. 1, two screening drums 21 are shown. The fiber material is blown into the housing 22 in the direction of the longitudinal axes of the screening drums 21. A circular flow 23 is generated when the fiber material is blown in from both sides of the screening drums 21 in counter-clockwise direction in this exemplary embodiment. Below the screening drums is a fluidized bed region 11. (See Fig. 1) The circular flow 23 through the screening drums 21 is superimposed by a normal flow and/or a flow that is essentially perpendicular to the circular flow 23 and is generated by a low pressure at the end 14 of the fluidized bed region 11 that results in air flow 13. The air flow 13 represents one option for larger, heavier fibers, which is not always required. The low pressure existing at the end 14 of the fluidized bed region 11 is generated by the low pressure of a suction-belt conveyor (not shown in Fig. 1), as well as by an air flow 17 through an exhaust pipe 16. (See Fig. 1) The normal flow 13 starts above the screening drums 21 and passes or flows through the sleeve openings of the screening drums 21, and then reaches and passes through fluidized bed region 11 until it reaches the end 14.

[0035] In the screening drums 21, the fiber material that is not or for the most part not separated reaches the inside

surfaces of the sleeves for the screening drums 21. The screening drums 21 rotate in a clockwise rotational direction 24. The mostly non-separated fiber material that is deposited on the inner sleeve surfaces of the rotating screening drums 21 is supplied to the separating drums 26. The separating drums 26 rotate counter-clockwise in the direction 25 and are located offset with respect to the center-axis of the screening drums 21. However, they can also alternatively rotate in a clockwise direction, as well as in any other conceivable variations of the rotational direction. The separating drums 26, which are needle rollers in the exemplary embodiment, pick up the non-separated fibers, tear them apart, and accelerate them. The fibers are tossed against the inner sleeve surface of the screening drums 21 until they have separated into individual fibers and have passed through and/or can pass through the sleeve openings of the screening drum 21. In an alternate embodiment, a drum with perforated sheets or a rod-type grids can replace the screening drum 21.

[0036] The separated fibers are picked up by an air flow and are guided and/or pulled through the sleeve openings in the screening drum 21. The air flow moves the fibers downward toward the fluidized bed 11 and along the fiber flow 18. As soon as the fiber flow 18 arrives at the fluidized bed 11, the flow 18

is deflected and guided along the curved fluidized bed 11. As a result of the centrifugal forces acting upon the fibers, the fibers move toward the curved guide wall and flow to the suction belt conveyor (not shown in Fig. 1). The air flowing along above the fibers is removed at a wedge and/or separator 15 and is released through exhaust pipe 16.

[0037] Optionally, individual fibers are picked up by an air flow 13 coming from a nozzle lip 12 and are also supplied to the fluidized bed end 14, wherein several nozzle lips can also be provided.

[0038] Fiber groups that are not or not completely separated following a single passage through one of the screening drums 21 reach the respectively parallel, second screening drum 21 via the circular flow 23. The separating device shown in Fig. 1 at least in part corresponds to the device disclosed in International Patent Publication No. WO 01/54873 A1 and/or U.S. Patent No. 4,640,810 A, which are assigned to Scanweb of Denmark and the United States and can be utilized in the present invention.

[0039] The fibers are essentially separated in a joint operation between the screening drums 21, the separating drums 26, and the air flow 19, 23 through the screening drums 21. In particular, essentially completely separated fibers are

ensured by providing that only separated fibers are able to pass through the openings in the screening drums 21.

[0040] The fiber flows 18, generated by the transport air, move the separated fibers in the direction of the fluidized bed end 14. The thickness of the fiber flow 18 through the fluidized bed 11 is continuously reduced as a result of the centrifugal force. The flow divider 15 is provided for separating the air from the fibers.

[0041] Turning to Figs. 2-4, the non-separated fiber material 49 travels via the accumulation chute 44 to the metering device formed by the two feed rollers 46, a metering channel arranged between the feed rollers 46, and the spiked roller 76. The schematic representation in Fig. 3 shows that the direction of the material feed-in 47 is downward and into in the drawing plane. The non-separated fiber material 49 is separated inside the separating device 10 (see Fig. 4). The separation of the fibers occurs through a joint operation of the separation rollers 26, an air flow 50, and openings in a grid or screen 77, which divides the separating chamber 45 from the space that is assigned to the fluidized bed 11. The air flow at the fluidized bed 11, generated by the air flow in the exhaust pipe 16, transports the separated fibers 27. As shown in Fig. 3, the direction of the air flow 17 in the exhaust pipe 16 is upward and out of the

drawing plane, wherein the air flow 17 also removes excess fibers.

[0042] The separated fibers 27 move along the fluidized bed 11 in the direction toward the fluidized bed end 14 where a conveyor 32, particularly a suction belt 43, is arranged. A low pressure exists at the conveyor 32 as a result of the air continuously being suctioned out, which is shown schematically by air flow 28. The low air flow 28 holds in place the separated fibers 27 against the air-permeable suction belt 43.

[0043] The suction belt 43 moves in the direction of the continuous rod machine 9, which is to the left in Fig. 2. A fiber cake and/or fiber flow 29 is compiled on the suction belt and increases nearly linearly in size in the direction toward the continuous rod machine 9. The compiled fiber flow 29, which varies in thickness, is trimmed with a trimming device 31 to reach a uniform size at the end of a compiling zone on the suction belt conveyor. The trimming device 31 can be a mechanical device, for example, trimming disks or plates, or a pneumatic trimming device such as air nozzles. In a pneumatic trimming device, a nozzle that discharges the air flow is arranged horizontally at the end of the fiber flow 29 and removes out a portion of the fiber flow 29, so that excess fibers 30 are removed. A circular or a flat nozzle can be used.

[0044] After the trimming operation, the fiber flow 29 is divided into a trimmed fiber rod 33 and an excess fiber rod 30. A nozzle can also be used to pick up and remove off all fibers below a trimming dimension. The excess fibers 30 are returned to the fiber preparation process and can later be used to form another fiber rod.

[0045] The trimmed fiber rod 33 is held against the suction belt 43 and is moved in the direction of the continuous rod machine 9. At this point, the trimmed fiber rod 33 is a loose fiber nonwoven which is compacted with the aid of a compacting belt 35. However, it is also possible to use a roller, for example, a press roll 55 as shown in Fig. 5, in place of the compacting belt 35 or to use several belts, rollers, and/or pulleys. As shown in Fig. 3, the fiber cake is furthermore also compacted on the sides by compacting belts 48 which are angled towards one another in the movement direction. The compacting belts 48 are operated in an exemplary embodiment at the speed of the suction belt 43. The serrated or toothed shape of the compacting belts 48 creates zones of varying density in the compacted fiber cake. The filter rod is later on cut in the zones with the higher density or compaction. The higher fiber density in the filter end region ensures a more compact

consistency of the fibers in this sensitive zone and, additionally, makes it easier to process the filter rods.

[0046] The trimmed and compacted fiber rod 34 is transferred to the continuous rod machine 9. For transfer to the continuous rod machine 9, the compacted fiber rod 34 is lifted off the suction belt 43 and the fiber rod 34 is then deposited on a format belt 58 and/or on a wrapping material web 42 on the format belt 58 of the continuous rod machine 9. (See Fig. 8) The format belt, which is not shown in the Figs. 1-4, and can be a standard format belt. The transfer is aided by a nozzle 36, which directs an air flow 37 from the top onto the compacted fiber rod 34. A fiber filter rod 38 is formed in the continuous rod machine 9 by pulling a wrapping material web 42 from a bobbin 41 and wrapping the wrapping material web 42 around the fiber material 38. A certain internal pressure builds up in the fiber filter rod 38 as a result of volume reduction and the shaping of the compacted fiber rod 34 into a circular and/or oval form during the wrapping with the wrapping material web 42 or, as shown in the following embodiments, before the wrapping with the wrapping material web 42.

[0047] Bonding components that are contained in the fiber mixture are surface heated and slightly melted in a curing device 39. For example, bi-component fibers can be used, the

outer layers of which can be melted so that a bond is created between the fibers. For this, reference is made to German Patent Document DE 102 17 410.5 owned by the assignee of the present invention. A plurality of fibers suitable for providing the desired filter characteristics can be used for the fiber materials, particularly cellulose acetate, cellulose, carbon fibers and multi-component fibers, particularly bi-component fibers.

[0048] In another exemplary embodiment, different fiber types are mixed prior to the formation of the rod. It is furthermore possible to add at least one additive, for example a bonding agent such as latex or triacetin or a granulate material, such as activated carbon granulate, which is particularly effective for bonding components of cigarettes.

[0049] In yet another exemplary embodiment, the length of the fibers is shorter than the length of the filter and/or the filter element to be produced. Consequentially, the fiber length in the exemplary embodiment should be between 0.1mm and 30mm and, in particular, between 0.2mm and 10mm. With respect to the length, the filter to be produced can be a standard cigarette filter and/or a filter segment for multi-segment filters used for cigarettes. If the average fiber diameter additionally is in the range of 10 to 40µm, in

particular 20 to 38μm, more particularly between 30 and 35μm, a very homogeneous filter can be produced.

[0050] The curing device 39 can include one or more of the following: a microwave heater, a laser heater, heating plates and sliding contacts. By heating the bonding components, for example in the outer layer of the bi-component fibers or latex material, the individual fibers in the continuous fiber rod will bond and melt together on the surface. The curing device 39 can also be used to dry bonding components which are added in liquid form. During the cooling down of the continuous fiber rod, the slightly melted regions of the heated bonding components will harden again. The resulting grid imparts stability and hardness to the continuous fiber rod.

[0051] The cured fiber filter rod 38 is subsequently cut into individual filter rod elements 40. However, the filter rod can also be cured following the cutting into individual filter elements 40.

[0052] Referring to the embodiment of Figs. 5-8 and in contrast to the continuous-rope machine 9 shown in Figs. 2-4, the separated fiber material 27 is compiled from above onto the suction belt 43 in transport direction 74. The separating device 10 of Figs. 5-7 represents a modified embodiment of the separating device 10 in Fig. 1. The separating chamber 45

contains screening drums 21 that rotate in the direction of the arrow 24. In a modified machine as compared to Fig. 1, however, the separating rollers 26, for example spiked feed rollers, are arranged in the center of the screening drums 21. As in the previous embodiment, the spiked feed rollers 26 function to tear apart and separate the fiber material that has not yet been separated and/or the cohesive fiber groups into individual fibers, so that the separated fibers can pass through the discharge openings in the screening drum 21 and into the funnel 53. Owing to the respective air flows and the force of gravity, the separated fibers 27 then reach the suction belt conveyor 43, which in this embodiment has suction belt side walls 57. (See Fig. 7)

[0053] A corresponding fiber nonwoven 29 is compiled on the suction belt 43. Excess fiber material 30 is removed from above with the aid of a trimmer 31 from the remaining fiber rod 33. The trimmed continuous fiber rod 33 is compressed with a press roll 55, which simultaneously functions in the rod conveying direction as the rear reversing mechanism of the suction belt 43'. Shortly after the press roll 55, the compacted continuous fiber rod 34 is held from above by a suction belt 43'. For this, a low pressure field 54 is generated with an air flow 28. An air flow 37 then flows through the nozzle 36 onto the

suction belt for removing the rod from the suction belt 43'. The compacted continuous fiber rod 34 is removed from the suction belt 43' with the air flow 37 from nozzle 36 and is transferred to a format device 56. In the process, the compacted fiber rod 34 is deposited onto a wrapping material web 42, which is conveyed on a format belt. The remaining process steps correspond to those shown in Figs. 2 to 4.

[0054] Referring to Fig. 8, which schematically shows a section of a machine in accordance with the present invention, the suction belt 43 is reversed around rollers 59. The gradually built-up fiber nonwoven 29 becomes the trimmed continuous fiber rod 33 following the trimming operation. The trimming device is not shown in Fig. 8. In the compiling region for fiber nonwoven 29 shown in Fig. 8, individual fibers 27 reach the continuous fiber rod from below.

[0055] The continuous fiber rod 33 is subsequently deposited on a wrapping material web 42 that is positioned on a format belt 58. The format belt 58 and the wrapping material web 42 are deflected with corresponding rollers 59, 59', respectively. In the region of a roller 61, the fiber rod 33 is deposited onto the wrapping material web 42, which represents the start of the format device 56 at which the wrapping material web 42 is wrapped around the continuous fiber rod 33.

[0056] Fig. 9 shows a view from above of the device shown in Fig. 8, and shows in particular side walls 57. The separating device is not shown in Fig. 9 for clarity. The side walls 57, which also adjoin the continuous fiber rod 29 and/or 33, are formed by suction belts 43 which, in turn, are reversed by reversing rollers 59''. In the illustrated embodiment, three suction belts are shown, which is useful if the fibers are especially short and thin, so that the fiber material is correspondingly held against the suction belt and/or the suction belts.

[0057] Fig. 10 illustrates a device for transferring the fiber rod from the suction belt 43 to the format device 56 and, in particular, to the wrapping material web 42. The continuous fiber rod (not shown in Fig. 10) is transported from the lower region of the suction belt 43, which is reversed with the reversing roller 59, to a clearance space between the opposite arranged belts 62 in direction 75.

[0058] The curved belts 62, which can be steel belts in an exemplary embodiment, are reversed with the aid of curved rollers 63. A circular hollow space is thus created between two opposite arranged belts 62. The continuous fiber rod passes through this hollow space with circular cross section and is deposited on the wrapping material web 42. The fiber rod 34 (see

Figs. 2 and 5) can be pre-formed and, if necessary, additionally compacted with the transfer device. The suction belt side walls 57 for this embodiment are designed as solid side walls.

[0059] Fig. 11 shows a section of a continuous rod machine 9, wherein in accordance with the invention, fiber flow 29, consisting of fibers 27 supplied from above through a funnel 53 and compiled on the suction belt 43 is conveyed to the operating range of a hugger belt 64, which is reversed around rollers 65. The respectively compacted fiber rod enters a nozzle 66 and is conveyed further with an air flow 67 to the wrapping material web 42 which rests on the format belt 58. The fiber rod 38 is subsequently wrapped with the wrapping material web 42 to form the continuous fiber filter rod 38.

[0060] An alternate embodiment for transporting the fiber rod 33 to the format belt 58 is shown in Fig. 12. The fiber rod 33 is conveyed by the suction belt 43 to the operating range of a nozzle 68, which blows compressed air 69 onto the fiber rod 33 in the region of the reversing roller 65, thus separating the continuous fiber rod 33 from the suction belt 43. The angle for the nozzle 68 and/or the compressed air 69 blown onto the fiber rod 33 can be adjusted. After the fiber rod 33 is separated from the suction belt 43, the fiber rod 33 travels to the ring nozzle 70. The air 67 flowing through the nozzle slit

71 can perform various functions, depending on the nozzle design. However, the function in the exemplary embodiment involves separating the fiber rod 33 from the suction belt 43, which runs around the reversing roller 65 and can also be designed as press roll 55, with the aid of the low pressure existing in the nozzle feed channel of nozzle 70. In addition, the compressed air 67 blown against the fiber rod at specific angles can convey the fiber rod to a first format-forming hollow cone 72, and. According to a modification, the compressed air 67 can dissolve the rod into individual fibers and/or fiber groups and thus convey the individual fibers and/or fiber groups into the first format-forming hollow cone 72, and subsequently into a second format-forming hollow cone 73. The format belt 58 with the wrapping material web 42 positioned thereon passes underneath the second format-forming hollow cone 73. The second hollow cone 73 has a smaller taper than the first hollow cone 72. The first format-forming hollow cone 72 contains venting bores which ensure the discharge of the nozzle air 69 and 67.

[0061] In another exemplary embodiment in which the fiber rod 33 is transferred as continuous fiber rod, the fiber rod is shaped from the top by the format-forming hollow cones 72 and 73 and from the bottom with the format belt 58 that passes through the format device. The complete transfer of the fiber

rope 33 to the format belt and/or the wrapping material web 42 occurs below the hollow cone 73. In the second variant in which individual fibers and fiber groups are pressed into the format-forming hollow cone with the aid of nozzle air 69, a backup of the individual fibers and fiber groups occurs because of the taper in the hollow cone, so that a new fiber rod forms. This rod is formed completely in the second hollow cone 73 and is transferred at the end of the second hollow cone 73 to the format belt and/or the wrapping material web 42. The wrapping material web 42 is then wrapped around the rod to form the continuous fiber filter rod 38.

[0062] In contrast to cigarette rod production, the difficulty with the continuous filter rod production, as in the present invention, is that filter materials having fine fibers with or without additives such as activated carbon granulate or powder must be formed into homogeneous filter rods. The various elements and/or devices must accordingly be configured so that the materials used are transported, held or processed in an optimum manner.

[0063] The fiber materials can be cellulose fibers, fibers of a thermoplastic strength, flax fibers, hemp fibers, linseed fibers, sheep's wool fibers, cotton fibers or multi-component fibers, in particular bi-component fibers having a

length that is shorter than that of the filter to be produced and a thickness, for example, in the range of 25 to 30μm. For example, cellulose fibers of the type "stora fluff EF untreated" by the company Stora Enso Pulp AB can be used, which have an average cross section of 30μm and a length of between 0.4 and 7.2mm. For the synthetic fibers such as the bi-component fiber, it is possible to use fibers with a length of 6mm of the type Trevira 255 3.0 dtex HM by the company Trevira GmbH. These fibers have a diameter of 25μm. Cellulose acetate fibers, polypropylene fibers, polyethylene fibers and polyethylene terephthalat fibers can also be used for the synthetic fibers. Materials that influence the taste and/or smoke can also be used as additives, such as activated carbon granulate or flavoring agents, as well as bonding agents that make the fibers stick together.

[0064] The invention has been described in detail with respect to exemplary embodiments, and it will now be apparent from the foregoing to those skilled in the art, that changes and modifications may be made without departing from the invention, therefore, as defined in the appended claims, is intended to cover all such changes and modifications that will fall within the true spirit of the invention.